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GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA

ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR.

REPORT

TO ACCOMPANY QUARTER-SHEET MAPS 3 S.E. AND 3 S.W.

SURFACE GEOLOGY.

NORTHERN NEW BRUNSWICK AND SOUTH-EASTERN
QUEBEC.

BY

R. CHALMERS.



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1887.

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ALFRED R. C. SELWYN, Esq., LL.D., F.R.S., ETC.,
Director of the Geological and Natural History Survey.

SIR:—I have the honour to present herewith a detailed report on the surface geology of the district comprised within the two quarter-sheet maps, 3 S.E. and 3 S.W., (northern New Brunswick and south-eastern Quebec), being the result of explorations and surveys made chiefly during the summer of 1885. The two map-sheets referred to, with colouring and notation to illustrate the surface deposits of the region, are now ready and will accompany this report.

My thanks are especially due to W. Mann, C. E., Bathurst, for a plan of the Caraquette Railway; and to H. A. Johnson, Dalhousie, and Miss Andrews, Bathurst, for barometric readings taken at the meteorological stations under their charge.

I have the honour to be,
Sir,
Your obedient servant,

R. CHALMERS.

OTTAWA, May, 1886.

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REPORT

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SURFACE GEOLOGY.

NORTHERN NEW BRUNSWICK AND SOUTH-EASTERN QUEBEC.

In the Annual Report, Geological Survey, 1885 (report gg) a general ^{Previous description of} description of the surface geology of northern New Brunswick is given, with a brief sketch of the geological relations of the deposits, remarks on their agricultural capabilities, etc. The present report is intended to be of a more detailed character, and besides, will embrace a certain part of the province of Quebec, especially the area drained by the Restigouche and other rivers falling into the Baie des Chaleurs. As the glacial phenomena of this region, as well as the distribution of ^{Influence of physical features.} the surface deposits, stratified and unstratified, have been so largely influenced by its more prominent physical features, it is only by viewing the drainage basin of the Baie des Chaleurs as a whole that it is possible to treat the surface geology in a connected and systematic manner. For this reason and also to complete the study of the area ^{Area explored.} included in the quarter-sheet maps, 3 S.E. and 3 S.W., the explorations of the season of 1885, extended beyond the limits of New Brunswick as stated, and the larger part of Bonaventure county was also examined. Moreover, the oscillations of level which the region, embraced in this report, underwent in the Post-Tertiary period as well as its glaciation are obviously so related to similar phenomena on the northern side of the Gaspé peninsula or Notre Dame Mountains that it seemed desirable and necessary, in elucidating them, that a cursory ^{Relation of surface geology of northern New Brunswick to that of south-eastern Quebec.} examination, at least, of the lower part of the St. Lawrence valley should be made. Accordingly, a short time was spent in the early part of the summer between Rivière du Loup and Métis, where a number of facts were discovered which, correlated with those of a cognate character observed in the Baie des Chaleurs district, must have an import-

ant bearing on investigations regarding the surface geology of eastern Canada. These facts may here be given in some detail:—

Observations at
Rivière du
Loup.

At Rivière du Loup, marine terraces were found at elevations of 225 and 345 feet;* in the lower of these, shells of *Saxicava rugosa*, *Macoma Grœnlandica*, *Mytilus edulis* and a species of *Leda* or *Yoldia* occur in Leda clay of unknown thickness, overlain by *Saxicava* sand to a depth of fifteen feet. The ridge on which Cacouna village stands is highly glaciated, the striæ running N.E. and S.W. or parallel to the general course of the St. Lawrence valley. The extensive terrace on which Cacouna station (263 feet high) stands is evidently of marine formation. On the road leading southward from this station, other terraces and old shore lines were observed, the highest being 340 feet. Fine blown sand occurs in the uppermost terrace. Along what must have formed the ancient beaches referred to, great numbers of boulders are strewn, chiefly of granite, gneiss, felsite, etc. Above the 345 feet contour line the surface appears to be more uneven, terraces are absent, and boulders not so numerous.

Cacouna.

St. Arsène.

An extensive marine terrace also occurs at St. Arsène station (277 feet high), in which shells of *Saxicava rugosa* were detected. Another behind it abuts against an old shore line or bank at a height of 340 to 345 feet. These terraces are continuous to Cacouna station, three miles distant.

Trois Pistoles.

Half a mile west of Trois Pistoles station (100 feet high), at a small stream, rocks were seen planed and striated in the direction of N. 2° W. In certain places they were rounded on the southern face and broken off abruptly on the northern. One exposure, however, which takes the *roche moutonnée* form, has, in addition to the ice markings mentioned, other striæ on the northern face (which slopes toward the St. Lawrence at an angle of about 30°), the direction being N. 35° E. or S. 35° W., i.e., nearly parallel the St. Lawrence valley. No rounded face (*stoss-seite*) showing in which direction the ice producing these moved, whether up or down the valley, was observed.

A few rods to the east of Trois Pistoles station, another small brook flows into the St. Lawrence, which, in the lower part of its course has cut a deep trench through boulder-clay. Just south of the railway track it falls in a cascade over a ledge which is finely planed and striated,—striæ N. 10° W.—rounded side (*stoss-seite*) to the south, the northern face being abrupt for several feet forming the cascade mentioned. Till rests on the glaciated surface. Numerous boulders of all

* The elevations are above high tide level; those of the Intercolonial Railway stations were obtained from profiles in the office of the Railway Department, Ottawa, through the kindness of Mr. Collingwood Schreiber, Chief Engineer. The bearings given are referred to the true meridian.

sizes up to six feet in diameter occur in the stream bed, the largest being derived from local rocks, but others of granite, gneiss and crystalline schist were noted.

On the road leading from Trois Pistoles station to the back concessions traces of marine submergence were observed up to a height of 345 to 375 feet. Below that level, blocks of granite, gneiss, syenite, felsite, etc. strew the surface in great profusion, all well rounded. Above the limit stated the boulders are, generally speaking, more angular, and fewer gneiss or granitoid ones occur, but a larger number belonging to local rocks. Several of a reddish granite or syenite, *i.e.* containing a large proportion of flesh coloured felspar, were however, met with. Glacial striæ were observed in different places up to the last back settlement, 800 feet high, the *roches moutonnées* and east-and-west ridges presenting, in all cases, the glaciated faces to the south. On a ridge in the third tier, striæ were noted with a course of N. 45° W. to N. 50° W., the ice-worn face (*stoss-seite*) to the south. The difference between the course of these and the striæ nearer the coast, is however, due to local inequalities of the surface.

Along the road from Trois Pistoles to St. Simon, glaciated rocks occur in several places, the rounded faces here also invariably to the south. A short distance to the south of St. Simon station (292 feet high) what appears to be the upper margin of the marine beds was seen along the face of an escarpment, at a height of 345 to 350 feet. A marked distinction was discernible here between the deposits below and above that line, the latter containing angular debris and the surface being without the sweeping rounded contours characteristic of those which have been under the sea. At the level of 375 feet, however, there is here, as at Trois Pistoles, a horizontal mark along the hill sides which may be evidence of an old shore line; but angular boulders of local rocks and the face of the escarpment mentioned are seen for 30 feet below it.

Near Bic station (75 feet high) polished rocks occur, but without distinct grooves or striæ. The ice producing these has moved up or down the valley in the direction of S. 48° W. or N. 48° E.

Going southward from Rimouski station (67 feet high) to the rear concessions, terraces at levels of 260, 330 and 367 feet were crossed, the one at 330 feet being the most extensive. The surface of the 367 feet terrace is somewhat hummocky and uneven, but a shore line is traceable here. Below this level, water-worn boulders of granitoid rocks are frequent, while above it, scarcely any, except a few of the red variety were met with, and the debris both large and small is more angular. This is the appearance presented as far as examined, up to a height of 625 feet, nothing like marine action on the surface being ob-

servable above the 367 feet contour line. Glaciated rocks and bosses with the ice-worn face (*stoss-seite*) in all cases presented to the south or south-west, were seen in several places, but no fine striae nor grooves.

St. Flavie.

At St. Flavie station (246 feet high) marine terraces were found extending up to a height of 340 to 345 feet, an old shore line appearing at that level. Immediately below this contour line, great numbers of drifted boulders, all well rounded, were observed, while above it, the surface became uneven and rolling and the boulders of gneiss, syenite and hornblendic rocks scarcer. On going into the back settlements a few of the reddish granitoid rocks were still seen, however, as far as observation extended, up to an elevation of 450 feet or more. A wide terrace occurs at St. Flavie at the 300 feet level, which however, has a slight slope towards the shore. Glaciated rocks with the worn faces to the south were seen in this vicinity.

St. Octave and
Little Métis.

Along the site of the railway at St. Octave station (561 feet high) and Little Métis station (675 feet high) nothing like marine beds was observed, the ground being uneven and hummocky. About 200 to 300 feet below this level, however, the great marine plain on the south side of the St. Lawrence can be seen stretching up and down the valley.

From these facts the following conclusions may legitimately be deduced:

Conclusions
respecting
glaciation and
subsidence of
St. Lawrence
valley below
Quebec.

1. That in the region along the south side of the St. Lawrence, below Rivière du Loup, there has been a subsidence of from 345 to 375 feet with reference to the present sea level in the Post-Tertiary period. Above the 375 feet contour line, no evidence of submergence was seen, and the hummocky nature of the surface, the general absence of foreign boulders, their more angular forms, and the obvious relations of such as are met with to the rocks of the district, support the view that the downward movement has not exceeded the limit stated.

2. That the glacier or glaciers which produced the south-to-north striation moved from the Notre Dame Mountains, or the adjacent watershed, northward, debouching into the St. Lawrence estuary, which must have been at least partially open during the period of their existence.

3. That the north-east and south-west striation has been produced by ice which moved up or down the St. Lawrence valley independently of that referred to in section 2, but whether contemporaneously or earlier or later, or whether the striae were caused by glaciers alone, or by icebergs, the facts at hand are not sufficient to enable us to decide.

The co-ordination of these phenomena with observations made on the surface geology of the Baie des Chaleurs basin will be brought under review in a subsequent part of this report.

The investigations in the Baie des Chaleurs district have resulted in the discovery of a number of additional facts of importance respecting

the glaciation, the formation of the drift beds, including the origin of the till, of kames, stratified deposits, etc. During the summer (1885) the Restigouche River and its principal affluents, the Quatawamkedge-wick, Patapedia, Metapedia and Upsalquitch, were ascended, and a series of observations in barometric hypsometry made, and the general elevation and surface features of the region drained by them ascertained. The valleys of the Scaumenac, Nouvelle, Cascapedia, Bonaventure and other rivers debouching into the Baie des Chaleurs were also examined, and the extent and fertility of the flats or intervalles bordering them noted. The forest growth, which is so rapidly being depleted by fires as well as by the lumberman's axe in some parts of the district, the size and relative abundance of the different kinds of trees, the distribution as affected by the geological formations or other causes, were likewise studied as far as time would permit, while attention was also given to the character of the soils and their relative values as derived from each of the series of formations within the area under review.

The surface deposits met with in the examination of the district included in the two quarter-sheet maps referred to, may be enumerated as follows in descending order:—

POST-TERTIARY DEPOSITS.

FRESH-WATER.		M 3.	MARINE.	Classified list of deposits examined in district.
1. Peat bogs.			1. Estuarine flats.	
2. Shell marl.			2. Salt marshes.	
3. Lacustrine and fluvial marshes.			3. Sand dunes.	
4. River flats (intervalles).				
		M 2.		
1. River terraces and kames of river valleys.			1. Saxicava sand and Leda clay, and kames of marine origin.	
2. Stratified inland gravel, sand and clay, and kames of the higher levels.			(The Saxicava sand and Leda clay often form sea-border terraces.)	
		M 1.		
		1. Till or boulder clay, moraines and erratics.		

Each of these formations, as it occurs in the district, will be described, and the locality and superficial extent defined on the map.

It is perhaps necessary to state that the section of country included in the maps is settled only along the coast and river estuaries, except near the towns, where occasional back settlements have been established on the second and third tiers of lots. Hence it was impossible to carry out a detailed system of investigation as regards its surface geology in the interior, as only along streams and lumber roads could

Difficulties attending investigations in the interior.

it be penetrated and the character of these observed. From the examination made, however, and the known distribution of the older rocks as mapped by R. W. Ellis, of the Geological Survey, it is believed tolerably correct knowledge regarding the interior, as well as along the coasts, has been obtained.

TOPOGRAPHICAL AND PHYSICAL FEATURES.

Topographical
features, where
and by whom
described.

The main topographical features of the region under examination have been described in previous reports by different geologists. Sir W. E. Logan and Mr. Richardson each explored portions of the area mapped, lying within the Province of Quebec (Reports of Progress, 1844 and 1857-'58), and the results of their work are given in the *Geology of Canada*, 1863. In Prof. Hind's *Preliminary Report on the Geology of New Brunswick*, 1865, the chief outlines of the topography of the northern counties are given; but it is to the reports of Mr. Ellis (Reports of Progress, 1879-80 and 1880-81-82)), that we are mainly indebted for details regarding its orographical and geological features. The writer has also sketched some of the chief surface characteristics in report 66. (Annual Report, 1885); so that in view of what has already been written respecting the region, it is unnecessary to do more at present than recapitulate the chief points in the descriptions referred to.

Restigouche
estuary.

The more salient features are the Baie des Chaleurs basin and the estuary of the Restigouche, the former merely a prolongation and expansion of the latter. The estuary mentioned is a shallow basin about twenty-two miles long and from one to three miles wide, lying in an east-and-west direction (magnetic) and surrounded by hills of trap rock which rise 500 to 1,000 feet above sea level.

Baie des
Chaleurs.

The Baie des Chaleurs is a broad sheet of water, the general direction of which is nearly east-and-west, occupying a trough about seventy-five miles long and fifteen to twenty-five miles wide. Its general depth can be seen from an inspection of the map. There is a gradual descent in the contour lines of its bottom eastward, and the depth increases beyond its mouth, for, outside of the Orphan Bank, the lead goes down, according to the charts, 450 feet or more.

Heron Island.

This beautiful expanse of water is without rock or shoal, and has only one solitary isle—Heron Island—lying off the coast of Restigouche county.

Baie des
Chaleurs a
valley of
erosion.

The hydrographical basin of the Baie des Chaleurs is in reality a wide valley of erosion originally formed in the Silurian rocks, which has been partially filled in to a height of 200 to 300 feet above the present sea level by Devonian and Carboniferous sediments. These

again were subjected to extensive denudation. Indeed the existing features are largely the result of erosive agencies continued since the land first rose above the sea, although the mountains and table lands are undoubtedly due to original disturbances and uplifts of the strata. Erosion has, however, been more effective in wearing down the rocks, especially the Lower Carboniferous, on the south side of the Baie des Chaleurs than on the north. From the patches and remnants of these found occupying sinuses and small marginal areas all around the coast, it is evident the whole basin of this sheet of water has been skirted and, perhaps, partially filled in with them, the chief portion of which has since been denuded.

In general, the surface of the land may be said to slope upwards from the shores of the Baie des Chaleurs on all sides to an elevation of 1000 feet or more, although within the limits of the maps reaching that height only in the west and north. The 200 feet contour line, marking approximately the upper limit of the marine deposits, gives an idea of the slope near the coast, but the general appearance of the country on either side of the bay is quite different. Along the Restigouche River and in the region west of the Cascapedia River embraced in the maps, the chief portion is a table land, intersected by numerous deep river gorges and ravines, the average elevation of which is about 1,000 feet above the sea. Mountains 1,200 to 1,500 feet high, or more, however, occasionally loom up, and a bold escarpment here faces the estuary of the Restigouche and the Baie des Chaleurs. East of Cascapedia River, the coast district, although not so high as that just referred to, nevertheless maintains an elevated, undulating aspect, exhibiting steep banks and cliffs along the shore in many places, with a surface behind, which, generally speaking, ascends till it merges into the table lands along the watershed of the peninsula.

On the New Brunswick side of the bay, to the south and south-east of the Dalhousie or Restigouche hills, the land is comparatively low, with gently rising, uniform, or slightly undulating contours, and is without any eminences, except the Blue Mountains near Jacquet River. This area has evidently undergone great and prolonged denudation, especially near the coast, for, although the rocks are much disturbed, the strata in many places crumpled and upturned vertically, they nevertheless exhibit a comparatively even surface.

To the south-east of the Baie des Chaleurs stretches the great Carboniferous plain of New Brunswick. It is a flat district, whose surface within the area mapped does not exceed 200 to 300 feet above sea level, the strata being comparatively undisturbed, and sloping very gently down beneath the waters of the Gulf of St. Lawrence.

A number of important rivers debouch into the Baie des Chaleurs, of

Physical features of Baie des Chaleurs district how originating.

Slopes and elevations.

Table lands.

Character of surface on south side of Baie des Chaleurs.

Rivers.

which the chief are Restigouche and Nepisiguit in New Brunswick, and Great and Little Cascapedia and Bonaventure in Quebec. In the table land referred to, these have cut deep trenches into the strata, and produced marked features in the landscape. On the lower grounds, however, the river valleys are comparatively shallow, but most of them have been filled to a greater or less depth, especially the estuarine portions, with till and stratified beds, during the glacial period and since.

Elevations
along Resti-
gouche River
and in the
interior.

The elevations of certain points along some of these rivers, and of the adjacent country, as measured by aneroid, may here be stated. They are in all cases above sea level. Along the Restigouche estuary, on both sides, the hills are 500 to 1000 feet; mouth of Metapedia, 20 feet; hills in this vicinity, 600 to 900 feet; mouth of Upsalquitch, 38 feet; general level here about the same as at Metapedia; Red Pine Brook, 170 feet; hills and general level near here, 700 to 900 feet; mouth of Patapedia, 220 feet; general level of country near river valley, 750 to 900 feet, but rising to 1000 or 1200 feet at some distance north of it; confluence of Patapedia and Awaganasees branch, 660 feet; general height of country here beyond valley, 1200 to 1500 feet; mouth of Quatawamkedgewick, 327 feet; hills near river, 600 to 750 feet; mouth of States Brook, on last mentioned river, 567 feet; height of measured hill here, 1300 feet, others rising 1400 to 1500 feet; Restigouche River, at limits of map, below mouth of Gounamitz, 380 feet; hills on both sides, 600 to 700 feet. On the Upsalquitch, mouth of Boland's Brook, is 117 feet, and confluence of north-east and north branches, 180 feet; general level of country in immediate vicinity of latter point, 500 to 600 feet. From these altitudes, it will be seen the country drained by the Restigouche rises towards the sources of the Patapedia and Quatawamkedgewick, and the lowest part is along the main river and the Upsalquitch. The maps show the elevations at all accessible points.

Changes in
drainage.
Former mouth
of Restigouche.

Some changes seem to have taken place in the courses of a few of the larger rivers, one of which may be referred to. During the Post-Tertiary subsidence of the region, the Restigouche had two mouths, and flowed partly out by the gap in the Dalhousie hills, through which the Intercolonial Railway now runs, and partly by the present mouth, Dalhousie Mountain forming an island. The Scaumenae River may have originally determined the existing outlet.

Lakes.

A number of lakes occur in the district, which generally form part of the river systems. They are all, so far as examined, held in by drift dams. The parallel valleys among the trap hills on the south side of the Restigouche estuary are occupied by a number of lakelets, 500 or 600 feet above sea level. The Blue Lakes near the Cascapedia

River are remarkable, especially two of them, for their azure or bluish colour (see report of Mr. Ellis, 1880-82). Some of the smaller lakes contain marl, and other lake basins were seen to be wholly filled with peat.

Following is a list of the elevations of the more prominent and accessible mountains within the area under discussion. Those noted on the maps indicate the surface features more definitely than any written description could. The datum line is high tide level of the Baie des Chaleurs.

	FEET.
Tracadigash Mountain.....	1,865
Nouvelle ".....	1,058
Maria ".....	1,230
Table land behind Tracadigash Mountain.....	1,700
Scaumenac Mountain.....	1,745
Dalhousie ".....	715
Sugar Loaf " Campbellton, N. B.....	950
Squaw Cap " Upsalquitch.....	2,000
Slate ".....	2,000
Port Daniel ".....	400

Bearing in mind the foregoing facts in relation to topography and elevation, we can now mark their influence on the great erosive forces which swept over the region, producing striæ, distributing boulder-clay, erratics, etc.

GLACIAL STRIÆ.

In the general list of striæ given in report 99 (Annual Report Geological Survey, 1885), all those known or observed in the district were recorded, but during the past summer (1885), a number of additional striæ have been discovered, especially on the north side of the Baie des Chaleurs. These, and others not previously noted, are included in the following table. Their courses are all referred to the true meridian.

Blue lakes near
Cascapedia
River.

List of moun-
tain heights.

List of striæ.

No.	LOCALITIES.	Course of Striae, &c.	General slope of surface.	Height above the sea.
GLOUCESTER COUNTY, N. B.				
1	At Bass River Mills, along Caraquette Railway.	N. 22° E.	N.	30
2	In Middle River settlement, on road side.....	N. 46° E.	N. E.	250
3	In Dumfries settle't, on central E. and W. road..	N. 56° E.	N. E.	250
4	" in another place on same road.	N. 46° E.	N. E.	200
5	In Robertville, on westernmost N. and S. road ..	N. 86° E.	N. E.	275
6	At Belledune, near P. O., on bank of shore.....	S. 54° E.	N.	Sea level.
RESTIGOUCHE COUNTY, N. B.				
7	In Archibald settlement, near school house.....	N. 12° E.	N.	225
8	" in another place on main road.	N. 21° E.	N.	200
In both of these places the <i>stoss-scite</i> of the rock is to the S. W.				
9	At Benjamin River, on bye-road to second concession lots.....	N. 76° E.	N.	
10	In Quatawamkedgewick River valley, 3 miles below mouth of McDougall's Brook. Grooves and striae.....	S. 38° E.	S. E.	520
The striae are parallel to that part of the river valley in which they occur. Till rests on the rock surface, but is now being rapidly worn away by the river (see section under head of till or boulder-clay).				
BONAVENTURE COUNTY, QUEBEC.				
11	Near Maguasha Point, <i>roches moutonnées</i>	S. 68° E.	S. E.	200
12	On E. side of Nouvelle Valley, on road to Parker settlement	S. 24° E.	S. E.	700
13	On road to St Louis Mountain settle't. Grooves..	S. 44° E.	S. E.	700
Ice in two last mentioned localities evidently flowed from table land along gorges into Nouvelle estuary and into W. end of Baie des Chaleurs, coalescing with glacier of Restigouche valley.				
14	At Black Cape, along road in several places, <i>roches moutonnées</i> , grooves and striae	S. 42° E.	S.	250
These striae, etc., have been produced by a body of ice which moved down the Cascapedia valley into the Baie des Chaleurs basin.				
15	At Port Daniel Mountain, <i>roches moutonnées</i> , and grooves, <i>stoss-scite</i> , N.W.....	S. 46° E.	S. E.	300
16	On second ridge E. of Port Daniel River, along road in several places.....	S. 44° E.	S. E.	225
17	At Point Maquereau, on road leading to light house and along main road in several places.	S. 44° E.	S. E.	300
The glaciers producing these striae have evidently debouched into the open bay.				

TILL OR BOULDER CLAY, MORAINES, ETC.

The occurrence of till and erratic blocks on the southern side of the Baie des Chaleurs was referred to in some detail in the report already cited, (Annual Report, 1885. Part 66.) Thick deposits of till were met with in many places near the coast, and in the interior of the country in river valleys. On the Quatawamkedgewick, a tributary of the Restigouche, it was seen near the mouth of McDougall's Brook, in the river's bank, resting on glaciated rocks at a height of 520 feet above sea level, (see list of striæ). The section here is as follows in descending order:—

- | | | |
|--|----------------|--------------------|
| 1. Stratified gravel and sand, overlain by a few inches of loam. | | |
| Thickness of whole | 15 to 20 feet. | Quatawamkedgewick. |
| 2. Till, consisting of gravel, sand and clay with a few boulders, which bakes hard on exposure | 3 to 5 feet. | |
| 3. Grooved and striated rocks, grooves parallel to direction of valley. | | |

The river having recently made a detour here, is now wearing away the whole of these beds down to the rock surface, thus exposing the striæ.

At Campbellton, a bed of till occurs in the bank of the Restigouche, Campbellton. overlain by stratified gravel, etc.

Just north of Nash's Creek, on the coast of the Baie des Chaleurs, a Nash's Creek. bed of till occupies sufficient breadth to enable us to map it. The Intercolonial Railway track passes through it by a cutting fully half a mile long, exhibiting a good section, and showing it to consist of a gray or reddish-gray clay, very tough and compact, and containing numerous angular boulders. The upper portion is more or less oxidized.

On the right bank of Jacquet River, near its mouth, a coarse reddish Jacquet River. clay and gravel, chiefly derived from the underlying Lower Carboniferous rocks, occurs, which contains glaciated boulders, and is evidently a true till.

At Tête-à-gauche and Nepisiguit rivers, beds of till met with there, Tête-à-gauche and Nepisiguit consist principally of the debris of the granite rocks occurring in the vicinity. These river valleys have been partly filled with it during the glacial period, the streams subsequently wearing channels through it. The deposits of till on their banks are, therefore, remnants only of the original mass. Along the Nepisiguit, however, they form a ridge which rises slightly above the general level, similarly to banks observed along the Miramichi and other rivers.

At Bass River, near the Caraquette railway track, a bed of till is seen Bass River. with glacial striæ beneath. Here and to the eastward, a sheet of till covers the surface of the Carboniferous rocks, overlaid by a thin deposit

HEIGHT ABOVE THE SEA.	
30	
250	
250	
200	
275	
Sea level.	
225	
200	
520	
200	
700	
700	
250	
300	
225	
300	

of stratified materials. Transported boulders of granite, diorite, felsite, etc., are consequently numerous on the surface. The land is quite flat, clayey, and wet in rainy seasons.

Till at Yacta Point.

A considerable bed of till occurs west of Yacta Point in Scaumenac Bay, composed of tough clay, mixed with boulders derived from local rocks.

At LeBlanc and Little Bonaventure Rivers.

On the coast of the Baie des Chaleurs, between LeBlanc and Little Bonaventure rivers—distance three miles—a thick bank of till is exposed, which is twenty-five to thirty feet high, and half a mile to a mile in width. It is here also composed principally of the debris of the Lower Carboniferous rocks, with a few travelled boulders from the interior of the peninsula. Decomposed rock *in situ* occurs here at different points.

Other localities of till.

Till was also noticed in the following localities:—On the sides of ridges between Point Maquereau and Port Daniel; at Black Cape, in hollows and on hill slopes; at the largest of the two lakes behind New Richmond, forming banks and damming up its waters; on the slopes of the hills along the Nouvelle valley, especially along the bye-roads to St. Louis Mountain and Parker settlements, etc.

Localities where decomposed rock occurs *in situ*.

In several parts of the district, especially in that tract occupied by Middle Carboniferous rocks to the east of Bathurst, the sandstone and conglomerates, partially disintegrated, can be seen in sections underlying the stratified deposits apparently undisturbed by glacial action. Transported blocks usually overlie these and sometimes boulder-clay, and the facts show that erosion from the ice of the Post-Tertiary period was not sufficiently powerful to remove the whole of the superincumbent decayed rock material from the rock surface beneath. It has, therefore, escaped abrasion, and resting immediately upon it is seen the rotted rock referred to,—the material from which till is formed.

Conclusion with reference to mode of occurrence of till.

Viewing the foregoing facts connectedly, it would seem that till forms the covering of a considerable portion of the solid rocks throughout the district, although largely concealed by stratified deposits. Wherever openings have been made in these, it is seen constituting a sheet of greater or less thickness, and invariably at the base of the series. The thickest beds of till, however, occupy sinuses, or the mouths of river valleys along the coast, or the lee side of ridges or hills which have protected them from denuding agents.

Morainic material.

No morainic material was noticed, except under the kames, where locally it occurs as masses of boulders partially rounded, but still preserving traces of glaciation. The fact that the Post-Tertiary glaciers which occupied the surface of the country, slid down into the Baie des Chaleurs depression, perhaps considerably below the present high water mark, may account for the absence of terminal moraines; but no lateral

ones seem to have been left either, except those referred to forming the bottom of the kames. Morainic beds under kames were observed at Dickie's Cove and in the Nouvelle valley.

BOULDERS, ERRATIC BLOCKS, ETC.

Considerable quantities of loose boulders are strewn over the surface of the district under examination, or imbedded in the till and other deposits. In general they appear, so far as they can be traced to their parent sources, to have been shifted eastwardly, or rather north-eastwardly, in northern New Brunswick, and south-eastwardly in Bonaventure county, Quebec; but there are exceptions to this rule, to which reference will presently be made. The great majority belong to rocks *in situ* in their neighborhood. The presence of large numbers of that almost ubiquitous kind—granite—in the area under review, seems, in

Boulders;
general
direction of
transport.

some instances, inexplicable, and encourages the belief that the laws or agencies governing their distribution are yet but very imperfectly understood. In the Middle Carboniferous district east of Bathurst, they are scattered about in such profusion as to give rise to the opinion that domes or bosses of the parent rock must have protruded through these strata in places at or immediately prior to the glacial period, although they cannot now be seen. Near Black Rock on the road from Pokeshaw to Millville, the surface in places is abundantly strewn with blocks, many of which are sub-angular and five to seven feet in diameter. Large ones were also noticed at Clifton and New Bandon; indeed, they are met with everywhere in that section,—in the interior, on the coast, on headlands, shores, islands, etc., down to the Gulf. Their occurrence is not so difficult of explanation there as elsewhere, however, as the ice of the glacial period is known to have moved from the south-west, carrying blocks from the granite area south of Bathurst, north-eastwardly in that direction, and the exposure of those occurring on the surface there as in other places, is, no doubt, due to the denudation of the finer and lighter materials.

Occurrence
of granite
boulders at
great distances
from parent
rocks.

How
transported.

In the district lying to the west and north-west of Bathurst, however, similar granitic boulders and others of crystalline rocks were observed. Those of granite are not so abundant as to the eastward, but are nevertheless, met with at Nigadoo and Elm Tree rivers not infrequently, and sparingly to Belledune and westward. In the interior, at the headwaters of Nigadoo, in the vicinity of the so-called silver mines, they were noticed 500 to 600 feet above sea level. Now, while those along the coast might have been, and probably were carried to their present sites by floating ice during the Post-Tertiary subsidence, having first been moved from the interior towards the coast by glaciers, the

Granite
boulders
occurring in the
interior above
the 200 feet
contour line.

How brought
thither.

granite boulders in the last mentioned locality, which is above the limit of this subsidence, could not thus have been transported. Indeed, it would appear as if the granite area along the Nepisiguit River referred to, had scattered its boulders or debris in every direction around the parent rock, although, as already stated, the blocks are larger and more numerous to the eastward and north-eastward, the direction in which the ice of the glacial period moved after passing over it.

Difficulties
regarding
presence of
granite
boulders in
the interior of
Restigouche
county.

The occurrence of occasional granitic and gneissic boulders in different parts of Restigouche county, associated with those belonging to other crystalline rocks, such as diorite, felsite, dolerite, etc., of known local origin, is another question beset with difficulties, according to the generally accepted theories of transportation. Upon the marginal area below the 200 feet contour line, they may have been distributed by floating ice; and the granitic boulders, sometimes noticed in the Restigouche valley proper, may have been borne thither from the Notre Dame or Shickshock Mountains by land ice, similarly to those occasionally met with in different parts of Bonaventure county. But it is not improbable that there are small granite domes or bosses* in the interior, not yet known, which have furnished the boulders now seen sparingly scattered over the surface of the great Silurian plain south and east of the Restigouche River.

Foreign
boulders.

It has been stated that no foreign boulders are found in the Gaspé peninsula.† This seems to be true as far as known, except on the low coast area along the St. Lawrence., but the same statement may be made in regard to northern New Brunswick as well, no boulders having been seen there, other than what are at least similar to rocks *in situ* in some parts of the drainage area surrounding the Baie des Chaleurs, whether derived from them or not.

Transportation
of boulders
in Bathurst
harbour.

An illustration of one mode in which boulders are sometimes transported may here be given. In the southern part of Bathurst harbour or basin (which is an estuarine flat) a considerable number of granite blocks, from one to seven feet in diameter, are strewn. These have been moved from the mouth of Middle River, distances of half a mile to a mile within the Recent period, by ice which forms in the basin and river every winter, as it is melted and carried out by the spring floods. This basin is being silted up, nevertheless, the boulders are kept on the surface, being rolled over or moved further down a few inches or feet, as the case may be, every season. Sir William Dawson has shown that boulders are similarly transported in the Lower St.

* Granite occurs on Benjamin River, Restigouche county, which was quarried during the construction of the Intercolonial Railway. See Mr. Ellis' report (Report of Progress, 1879-80, p. 47 D.)

† Dr. R. Bell was, I believe, the first to call attention to this fact in a paper published in the *Canadian Naturalist*, Vol. VIII. (1863)

Lawrence valley. In the course of ages, erratics may thus have been moved great distances.

CONCLUSIONS RESPECTING THE GLACIATION OF THE BAIE DES CHALEURS BASIN AND GASPÉ PENINSULA.

The striæ and the direction in which the boulders of local rocks, as well as the till, have been transported, indicate that ice, which mantled the country surrounding the Baie des Chaleurs during the glacial period, moved down the slopes from the north, west and south into its basin. In the Gaspé peninsula, ice probably covered the whole table-land south of the watershed, and was controlled in its flow by the larger river valleys. The hilly tract in the northern part of Restigouche county, drained by the river of that name, was similarly clad with ice, which also followed the courses of the principal valleys. On the southern side of the Baie des Chaleurs, however, from Eel River to Elm Tree River, the ice covering appears to have moved independently of surface inequalities. The land is comparatively low, with an even surface near the coast, and the trend of the ice movement was diagonally across the minor valleys eastward and north-eastward, to the deeper part of the Baie des Chaleurs basin. This fact lends countenance to the view that the ice which flowed down the Restigouche, Nouvelle and Cascapedia valleys, coalesced in the Baie des Chaleurs basin, forming a local glacier which occupied the whole western end of the depression. The portion of the bay lying east of Belledune Point, or Petite Roche, appears, however, to have been open, for the courses of the striæ at Port Daniel and Point Maquereau, as well as on the New Brunswick side at Nigadoo, Dumfries, Bathurst and Bass River, show an ice flow more directly into it, uninfluenced by other ice movements from the west. At Belledune and Elm Tree River, however, later and finer striæ, crossing the deeper grooves at a wide angle, indicate that smaller local glaciers, debouched into the bay after those referred to had retired, or they may have been produced by icebergs.

The striæ observed in the valleys of the Quatawamkedgwick, Metapedia (see list of striæ, *Geology of Canada*, 1863, p. 892, No. 139), and Nouvelle indicate, as stated above, that glaciers flowed down these; and the facts when correlated with observations made on the south side of the St. Lawrence, referred to on previous pages, afford proof that the existing watershed of the Gaspé peninsula, and of the region to the south-west shed the ice which accumulated on it northward and southward, as it now sheds the waters due to precipitation.

No positive evidence regarding the striating action of the icebergs

Glaciation how
effected in Baie
des Chaleurs
basin.

Striæ in Quata-
wamkedgwick
and Metapedia
river valleys.

Action of
icebergs or
floating ice.

of the glacial epoch was obtained around the shores of the Baie des Chaleurs, except it be such as is referred to above, occurring at Belle-dune and Elm Tree River. That icebergs have been instrumental in the transportation of boulders, however, seems beyond question. The blocks met with near the coast, which have been carried from the parent beds in a direction contrary to that of the ice-flow, were, no doubt, moved by them. Moreover, although proof is wanting that icebergs have produced striæ on rock surfaces, they appear to have had a powerful denuding effect, along with coast and pack ice, especially on the southern side of the Baie des Chaleurs. It has been already stated that the coast area, east of the Dalhousie hills, presents a uniform surface, sloping at a low angle from an elevation of 200 to 300 feet down underneath the waters of the bay; and that while the strata are much folded and crumpled, and cut by dykes of diorite, and other eruptive rocks; they have all, nevertheless, been denuded and planed off nearly level. Obviously, therefore, other agencies as well as the sea and land ice have been in operation here, levelling the surface. And it seems almost beyond a doubt that these have been coast and floating ice and icebergs of the Post-Tertiary and preceding ages, if we may suppose such to have existed. That the erosion here witnessed must have been prior to the final melting of the glaciers is shown by the presence of striæ still retained by the rock surfaces.

Effects of
floating ice at
present day.

The effects of coast and floating ice can be observed even at the present day in the same locality. Easterly winds drive in packs every winter and spring, pushing them against the shores of the southern side of the Bay, levelling down the zone between high-water mark and the ten to fifteen feet contour line below it. Similar erosive agencies have undoubtedly been in operation for long ages, as the coast area oscillated in level, which would be intensified when the waters of the Baie des Chaleurs covered a larger area. That the chief denudation which the surface of the district underwent was, however, pre-glacial and sub-aerial, admits of no question; but the agencies referred to serve to explain the uniformity of surface which the latter could not effect.

STRATIFIED INLAND GRAVEL, SAND AND CLAY.

Stratified
inland gravel,
sand and clay,
where found.

Everywhere outside of the river valleys, above the 200 feet contour line, deposits of stratified gravel, sand and clay occur, forming the largest portion of the cultivable soil within the area mapped. For the most part, these beds are quite thin, usually resting on the till or rock debris; but on slopes and in hollows they are often a foot or more in thickness, constituting lenticular sheets, more especially the clayey portion, which appears to have been washed down from the hills and ridges

wherever there are rolling or uneven surfaces. The chief agent *How formed.* in stratifying or remodelling these from pre-existing beds was, no doubt, the waters resulting from the melting of the snow and ice of the glacial period, at or near its close. In certain hollows, lakes or ponds existed at that time, which have since dried up from drainage or evaporation. Streams also flowed through nearly all the minor valleys then, where now they may be seen only for a short time during the melting of each winter's snow. These would be important agents in remodelling the surface materials. Over a large part of the district mentioned, however, these inland surface deposits are really till, or the rock debris from which till is derived, with the upper portion oxidized and partially modified through atmospheric action such as rain, frost, melting snow, etc., and by the rooting of plants and their decay. Wherever the surface was irregular, these agencies, by loosening the soil, would keep it in such a condition that it could be readily moved from higher to lower levels by ordinary sub-aerial processes, so that, in the lapse of ages, these apparently insignificant means would result in changes of great importance as regards these surface beds. As illustrating the character and depth of these inland deposits, the following sections may be instructive:—

1. At the confluence of the Metapedia and Restigouche rivers, in a Section of stratified inland deposits at Metapedia. hillside, a stream of water from a bursting reservoir cut a channel into the surface beds six to ten feet deep, exposing the rock surface beneath, which was not glaciated, and affording a good section. The principal mass was seen to be local rock debris, unstratified, and apparently formed *in situ*. The uppermost twelve to fifteen inches were, however, oxidized and partly stratified from the materials sliding down hill.

2. In St. Alexis settlement, which has a rolling surface 800 to 1000 St. Alexis feet above the sea, the deposits are:—

- (1) Stratified sand, gravel, or clay on the surface, from two or three inches to a foot or more in thickness.
- (2) Till in places, but sometimes rock debris resting on the upturned ragged edges of the fragile, decaying Silurian slates. The till, oxidized on the surface, seems to cover, indeed, a large part of the district.

3. On a hill behind Paspébiac, 210 feet high, the surface deposits Paspébiac are somewhat similar, viz:—

- (1) A few inches to a foot or more of oxidized and modified rock debris finely comminuted by atmospheric action, and in places stratified.
- (2) Decayed rock material, derived from the underlying Lower Carboniferous sandstones, which, for the most part, has been changed to till by glacial action.

RIVER TERRACES.

River terraces. The river valleys in this district are all terraced throughout at various heights, the terraces all corresponding in size with the rivers, as stated in previous reports, except near their mouths, where they are of marine formation. The Restigouche and its larger affluents, and the Nouvelle, Cascapedia, Bonaventure, etc., exhibit terraces of greater or less extent. On the Restigouche, the highest are at the following places, (the heights, unless otherwise mentioned, having reference to that of the river at the nearest point).

Occurrence of
terraces along
Restigouche
River and its
branches.

1. Red Pine Brook, a terrace 20 to 30 feet, another 30 to 40 feet high. These are narrow and somewhat uneven.

2. Mouth of Patapedia on left bank, a terrace 50 feet high.

3. On opposite side of Restigouche, a terrace three-quarters of a mile long, kame-like, and also about 50 feet high. This terrace extends up the Restigouche valley, on one side or the other, nearly to White's Brook.

4. Opposite Stillwater Brook, terraces are seen 20 to 30 feet high, forming the point in the river bend here.

5. In Quatawamkedgewick valley, below Falls Brook, terraces are seen 20 to 30 feet high. None higher than these occur on this river.

6. On Patapedia, the terraces do not exceed 20 to 30 feet in height, and are all narrow.

7. Terraces near the mouth of Upsalquitch, on that river, are 20 to 40 feet high. Further up they are usually lower, except at the upper falls, six to seven miles below Upsalquitch Lake (see preliminary report *eg.*, Annual Report, 1885).

Along Metapedia River terraces occur at the mouth of Assemetquagan twenty to thirty feet high, but narrow. At Milnekik branch they are thirty to thirty-five feet high, and extend along Metapedia one to two miles. Above that, to Assemetquagan station, Intercolonial Railway, they are narrow and not more than ten to twenty-five feet high.

No noteworthy river terraces were observed on other rivers within the limits of the maps; and the above represent the highest in the district, except it be at waterfalls.

MARINE TERRACES AND KAMES.

(*Saxicava Sand and Leda Clay*).

Marine
terraces.

Marine or sea-border terraces were met with all around the Baie des Chaleurs, and often extending up river valleys many miles. The Restigouche exhibits these formations as far up as the confluence of the Upsalquitch, thirty-six miles from its mouth, and the Metapedia,

as far as Millstream branch. The Cascapedia, Nouvelle, and Bonaventure valleys are likewise terraced with marine deposits for considerable distances, the former especially beyond the limits of the map.

A marked difference exists between these and river terraces as regards elevation and area. For example, on the Restigouche and its affluents, no river terraces occur higher than 40 to 50 feet above the stream alongside of them; but as we approach its mouth, especially within five to fifteen miles of tide head, we find marine terraces 150 feet high or more. The same distinction holds good with reference to river and marine terraces on the Nouvelle, Cascapedia and Bonaventure rivers. These elevated terraces, although formed in estuaries or tidal inlets during the Post-Tertiary submergence, and leveled off by the sea, have nevertheless derived the material which composes them from the rivers; in other words, they have been formed of river detritus at or near the head of tidal waters during the Post-Tertiary subsidence.

The terraces found around the coast of the Baie des Chaleurs likewise consist of the debris of the rocks within its drainage basin, and have been modelled chiefly by the sea. No well defined ones were observed at a greater elevation than 175 to 200 feet above tide level, unless it may be some occurring at Port Daniel, described below. Fossils are found in nearly all these terraces, being most abundant, however, around the mouth of rivers, and within the area of the Silurian limestone.

Marine terraces are invariably formed of (1) Saxicava sand, which changes on the one hand into a coarse gravel or detritus with small boulders, and on the other, to fine sand without admixture of other material; (2) Leda clay, fossiliferous in the uppermost strata, the whole usually resting on till, rock debris, or occasionally on kames.

Over a large part of the area under review, these marine deposits (Saxicava sand and Leda clay), are not regularly terraced, however, but occur as thin or lenticular sheets upon the surface of the boulder-clay, or rotted rock material, as the case may be. And, although from the elevations of the terraces under discussion it is evident the sea has invaded the region to a height of about 200 feet above the existing sea level, yet long stretches of the coast area below the 200 feet contour line bear no traces of submergence. Certain tracts on the New Brunswick side of the Bay may be mentioned, as for example, (1) between Jacquet and Tête-à-gauche rivers, and (2) east of Bathurst to the limits of the map. These slope down to the shore, and are unterraced, except at the mouths of the rivers and brooks. In Bonaventure county a similar want of terracing is apparent in many localities. The facts tend to show that terracing has taken place, as stated, chiefly at or near the mouths of rivers, and that these have supplied the principal portion of the material.

Section of
marine
deposits.

In the untterraced coast areas, below the 200 feet level, the beds, so far as examined, consist of the following series:—

1. Saxicava sand or gravel, with boulders and travelled blocks of various sizes. Deposit generally thin.
2. Leda clay; thin but sometimes in lenticular sheets of a few feet in thickness. Seldom containing fossils.
3. Boulder clay or rock debris, of various depths.

Leda clay
resting on till.

Often, however, one or the other of the series is wanting. A fine example of Leda clay overlying and resting on till, the latter with a smoothed surface, can be seen at Miller's Crossing, Intercolonial railway.

Description
of marine
terraces.

Following is a description of the principal marine terraces. The elevations are referred to high tide level, and the courses of kames, etc. to the true meridian.

Bathurst.

1. Extensive terraces occur around Bathurst harbour, stretching eastward to Salmon Beach, and westward to Peter's River, occupying an area of not less than twenty-five square miles. They are considerably denuded by the four rivers which here flow into this harbour; but the elevation of the upper ones is 125 to 175 feet, reaching 190 feet in the rear of St. Ann settlement, and along Tête-à-gauche River. Fossils are found in them at Bathurst and Tête-à-gauche.

Jacquet River.

2. Around the mouth of Jacquet River and extending westward to Nash's Creek and some distance beyond it, a series of terraces occurs, the highest of which is 150 to 175 feet. These are likewise much denuded. Fossils at Jacquet River and Louison Brook.

Charlo River.

3. Well-defined terraces occur around the mouth of Charlo River, rising, at the distance of two miles from the shore, to a height of 150 feet, and in Mountain Brook settlement, between Charlo and Eel rivers, 165 feet. Fossils.

Along
Restigouche
River, south
side.

4. In the Restigouche valley (south side) terraces occur in the following places:—At Campbellton, 10 to 30 feet high, with fossils; at Christopher's Brook, extending up that stream to Glencoe and Glenlivit settlements, the highest one being at the end of the Glencoe road, 180 to 200 feet; at Flatlands, along road to Glenlivit settlement, another 160 feet high, and at Dawsonvale a narrow one 180 to 190 feet high, a short kame parallel to Rafting-ground Brook standing upon it.

Runnymede.

5. Returning, on the north side of the Restigouche valley we find at Runnymede a series of terraces along the face of the slope behind the flat which occurs here, 75 to 90 feet high; three to four miles further down, another series, the highest about 90 feet, with fossils (*Mya* and *Macoma*) in lower ones; at mouth of Metapedia, several terraces. Fossils. (See Annual Report, 1885, p. 45 *gg.*, for section of these.)

Metapedia
River.

6. Along Metapedia River, opposite mouth of Mill-stream, a ter-

race occurs 70 to 75 feet above that river, or about 200 feet above the sea, extending along the valley several miles, although not more than 100 to 200 yards in width. If this terrace was formed when the Metapedia valley was flooded by the sea, as is assumed, it marks the upper limit of the Post-Tertiary submergence here. Farther down the valley lower terraces skirt it on one side or the other till it joins the Restigouche.

7. Just below the mouth of Sellar's Brook, a terrace 175 to 180 feet ^{Sellar's Brook to Bourdo.} high occurs, and others are seen stretching along the river a mile or two farther down; also at the mouth of Little River and at Bourdo, terraces are found at different elevations, but none high.

8. At Oak and Battery Points terraces 150 feet high lie behind the ^{Oak and Battery Points.} kame seen at these places. Fossils.

9. Terraces are met with at Harrison's Brook and along the shore ^{Scaumenac River.} towards Scaumenac River; also, up the river about three miles, one 140 to 150 feet high was seen.

10. On the west side of Nouvelle valley, along the main road, three ^{Nouvelle valley.} well-formed terraces were observed, the highest 150 feet. These extend down river two miles or more; also, two to two and a half miles above the middle bridge, on the east side, another a mile or more in length and about 125 feet high; and a third behind kame No. 3, described below, stretching towards foot hills at a height of 80 to 100 feet. Other lower terraces intervene on river-ward side of kame.

11. Behind Shoolbred, terraces skirt the base of the mountains at Shoolbred, various elevations, but none exceed in height those just described.

12. Two to three miles west of Carleton a terrace 125 to 140 feet high ^{Carleton.} is seen between a rocky ridge and the mountains.

13. East of Carleton, extensive terraces extend from the lagoon inside ^{Carleton Point to Maria.} of Carleton Point to Maria, six or seven miles, and from the shore back to the foot-hills (see map); height 130 to 140 feet. The highest or outer margin of these forms kame No. 4, called Maria Capes. Along base of mountains another narrow terrace rises to a height of 175 feet. Fossils.

14. Behind Maria P.O., along Green's Brook, extensive terraces like- ^{Green's Brook.} wise occur at elevations of (1) 50 to 75 feet, (2) 110 feet, and (3) 175 feet, the latter close to foot-hills.

15. At Blue Lakes, Irishtown, terraces 150 to 175 feet high are ^{Irishtown.} found, in which some of these lakes lie. They extend along the banks of Manderson's Brook and around certain hills between that and Cascapedia River, (see map).

16. Extensive terraces border the Cascapedia River as far up as the ^{Cascapedia River.} limits of the map, and beyond it, the highest rising 150 to 175 feet above sea level. The terrace on the left bank for five miles up from

the river's mouth has been cut into a magnificent kame (kame No. 5).

Little
Cascapedia
River.

17. Terraces occur on the left bank of Little Cascapedia River, three miles up from the main post road, 150 to 180 feet high.

Capelin.

18. Behind Capelin wide terraces were seen at different elevations, highest 190 feet. Some of these are, in reality, benches made in the Lower Carboniferous rocks, but are, nevertheless, covered by water-worn gravel.

Bonaventure
River.

19. Along Bonaventure River, west side, wide terraces, 65 to 75 feet high, extend; and on east side, going up the road to back settlements, four terraces were seen in succession, at heights of 50, 70, 100 and 150 feet, the last one narrow.

Port Daniel.

20. On the west side of Port Daniel, terraces occupy a considerable area, the highest of which are 225 to 240 feet. They are underlaid by Lower Carboniferous rocks, however, and their terraced appearance may be owing to the horizontality of these; but they certainly have rolled, water-worn gravel on their summits. No fossils were found in them.

Anse à la
Barbe.

21. At Anse à la Barbe, a terrace was observed 100 to 125 feet high, much denuded by the stream.

Many others, not here noted, occur in the district, but the foregoing will exemplify the extent and elevation of the marine terracing, and the subsidence the region underwent during the Post-Tertiary period.

Marine Kames.

Marine kames. These kames, which usually occur along with the terraces last described, have been met with in the following localities:—

Restigouche
kame.

1. The Restigouche kame extends along the coast from Charlo River to Nash's Creek. (For description, see Annual Report, 1885, p. 30 *g. g.*)

Battery Point.

2. A kame about one and a half miles long extends from Oak Bay to Battery Point, in the Restigouche estuary; course about N. 80° E.; height 150 to 175 feet. River-ward face steep, but inner side slopes away towards hills at a low angle. It consists of a series of hummocks.

Nouvelle.

3. In Nouvelle valley, a kame stretches from the R. C. Church to the river's mouth, three and a half to four miles; course S. 50° E. or parallel to valley; height, 80 to 100 feet. River-ward face steep. This kame is really the high outer margin of a terrace.

Maria.

4. This kame, like the last, is also the high border of a wide terrace, and consists of a series of hummocks stretching along the coast between Maria and Carleton, a distance of fully five miles. Course nearly S. W. and N. E.; height 140 to 150 feet. These ridges and hummocks are widest at the northern end.

Cascapedia.

5. This kame, already referred to, which extends along the east side

of the Cascapedia for five miles, is the finest in the Baie des Chaleurs basin. Course N. and S.; height 100 to 150 feet. It is wider and higher at the upper end and terrace-like in places, being, in fact, a denuded terrace, worn away by the river on one side, and by several small streams, tributary to it, on the other. These, as the land emerged from the Post-Tertiary sea, flowed in a direction nearly parallel to the river for some distance, eroding the east side of the kame.

6. Between two small lakes behind New Carlisle, the larger of which is called Dark Lake, a kame extends one and a half to two miles, holding up the waters of the other fifteen feet above it. Course N. 75° E. Height of Dark Lake, 160 feet. Gravel ridges or kames, the summits of which are 190 to 200 feet high, encompass these lakes.

RIVER FLATS OR INTERVALS.

These formations embrace the lowest of the terraces or steps along river banks, and are distinguished from the latter, on account of their being annually or periodically overflowed by freshets. They seldom rise more than eight or ten feet above the ordinary summer level of the rivers, and are capped by loam of varied texture, from a few inches to several feet deep. In some of the lower intervalles, nothing, except the loam, is visible; but in making openings in them, gravel beds, and in some cases, clay, are found underneath. They occur in all river valleys above tidal waters. Those flats which are met with near the mouths of rivers, below the 200 feet contour line above sea level, are, however, partly of estuarine and partly of fluvial origin. During the Post-Tertiary subsidence, marine beds consisting of Leda clay and Saxicava sand, often holding sea shells, were deposited in river valleys above existing tidal waters in what were then estuaries; but on the emergence of the land subsequently, the rivers again flowed over these estuarine bottoms, eroding them and depositing sand, loam, etc., upon them in certain places. Sections of these flats would show the stratified portion of the beds to consist of: (1) loam or fine sand, (2) river gravel, (3) Saxicava sand, (4) Leda clay, etc. They were generally of wider area than those intervalles solely of fluvial formation occurring in the interior, and comprise the very best farming land in the district.

Along the rivers within the region mapped, the most extensive intervalles, altogether of fluvial origin, are found on the upper Restigouche at the confluence of the larger tributaries, such as the Quatawamkedgewick, Patapedia, Upsalquitch, etc. As they are met with, however, on almost every river and stream of any size, only the largest and most important will be here described, and all river-flats will be classed together in this report, reference being made particularly to those underlain by marine deposits:—

River flats,
occurrence
and mode of
origin.

Section of
these.

River flats on
Restigouche
and other
rivers.

Tête-à-gauche
River.

1. Near the mouth of the Tête-à-gauche River, at Somerset Vale farm, excellent intervalles, dotted with elms, maples and clumps of spruce, may be seen. These have marine beds underneath.

Marine and
fluvial flats
(intervalles)
along the
Restigouche
River.

2. In the Restigouche valley, fine intervalles occur at Athol House, Flatlands, Metapedia and Runnymede, which are partly marine, while others, altogether of fluvial origin, were observed at Deeside, Patapedia, Tracy Brook, Quatawamkedgewick, etc., being usually of greater extent at the mouths of these affluents. In many places, these flats are half a mile or more in width, and form excellent soil. Along the chief tributaries of the Restigouche, flats of considerable area likewise occur, but usually narrower than on the main river. On the Upsulquitch, near its mouth, a fine intervalle two to three miles long was seen, and another occurs at the confluence of the north branch.

Nouvelle.

3. In Nouvelle valley an excellent intervalle stretches from tide-head three to four miles up, beyond which there is a constriction in the valley. Above this another occurs, called the "big flat."

Cascapedia.

4. Along the Cascapedia, intervalles and islands extend as far up as the limits of the map and beyond it. They comprise a number of good farms, and are nearly all cleared and occupied.

Little
Cascapedia.

5. A wide flat is found on the east side of the Little Cascapedia, extending up the valley as far as the road goes. (See map.)

The intervalles described as occurring along the last three rivers, consist of Leda clay and Saxicava sand overlain by loam of fluvial formation.

Bonaventure.

6. Along Bonaventure River intervalles stretch from the head of the tide, at a varying width, to within a short distance of the mouth of Duval River. In the vicinity of the mouth of Hall's River, there seems to be a considerable area of good bottom land. The larger portion is still covered by forest.

Port Daniel.

7. The Port Daniel River is skirted along its several branches by narrow flats of limited area. Except for a short distance up the East River, the district traversed by these streams is also covered by forest.

LACUSTRINE AND FLUVIAL MARSHES.

Lacustrine and
fluvial
marshes.

Deposits of this character are of very limited extent in the district included in the maps, owing to the fact that the lakes are small and the rivers rapid, usually flowing over gravelly bottoms. Narrow belts of marsh fringe the lakes behind New Carlisle, also those near Campbellton, and along the head waters of the various rivers. The larger lakes at the head of Patapedia and Métis rivers were not visited; but from the information gathered they appear to be partially bordered by marshy grounds.

Wherever there are "dead waters" at or near the sources of rivers or brooks, small marshes or peaty areas skirt them.

SAND DUNES.

Sand dunes occur at Pokemouche gully and Point Mizzenette, also ^{Sand dunes, where found.} along the shore from the latter place to Blue Cove. Alston and Carron Points, at the entrance to Bathurst harbour, are of this character, while Belledune and Little Belledune Points, Eel River bar, and Carleton and Paspebiac Points, which are all formed of sand thrown up by the waves, enclose lagoons into which the tide flows. Other accumulations of sand are met with at the mouth of Jacquet River, and at Nouvelle and New Carlisle. A sand spit is also in process of formation on the inner side of Heron Island. The mode of origin of these sand beds has been described in the preliminary report referred to, 1885.

SHELL MARL.

Shell marl is found at Belledune, near the shore, underlying a peaty ^{Shell marl, localities of.} deposit; also at Charlo River, in the bottom of a lakelet, where it is fully exposed, and is reported to be nine feet deep. The farmers in the vicinity of the latter place sometimes cut holes in the ice during winter, and dig it up for fertilizing the heavier clay soils overlying the Lower Carboniferous rocks there. In New Richmond, marl also occurs in a lake bottom (see map) in the third concession. In none of these localities, however, is it used in any great quantity for fertilizing purposes, owing to the lime already in the soil, derived from the subjacent calcareous slates (Silurian), which renders its application, to a large extent, unnecessary.

PEAT BOGS.

Peat bogs, which are sometimes, when large, called "caribou plains," ^{Peat bogs.} are common in the district occupied by the Middle Carboniferous rocks, on the south side of the Baie des Chaleurs, owing chiefly to insufficient drainage, resulting from the flatness of the surface. On the Silurian uplands they are less numerous, and are usually of smaller area. No attempt has been made to utilize peat in any way in this part of the country. For a description of some of the more accessible of these beds, see the preliminary report above referred to, page 47 *gg.* The following bogs or peaty barrens were noted during the season of 1885:

1. A bog occurs in the middle of the peninsula terminated by Point ^{Point Mizzenette.} Mizzenette, Gloucester county. Two small lakes lie in it which are drained by a little stream into Blue Cove.
2. About half a mile north of the Waugh River, at Pokemouche, ^{Waugh River.} the road crosses a peat bog half a mile long and about 200 yards wide.

- St. Simon's Inlet. 3. At the southern end of the road going from Lower Caraquette to St. Simon's Inlet a small bog crosses it.
- Pokemouche gully. 4. A bog or "cranberry barren" of considerable extent occurs south of Pokemouche gully, skirted by salt marsh (see map).
- Belledune. 5. A small peat bog is seen at Belledune, just south of the point.
- Charlo River. 6. A similar one occurs east of the mouth of Charlo River. (These two, Nos. 5 and 6, are mentioned in the preliminary report, p. 47 *aa.*)
- Bonaventure. 7. Peaty areas are of frequent occurrence on the surface of the Lower Carboniferous rocks in Bonaventure county, but they are of little depth, and generally form cedar swamps. One of these is crossed by the first road going to the second concession north of Bonaventure River, and seems to be of considerable extent.
- Cullin's River. 8. A small peat bog was seen along the road going back on the south side of Cullin's River.
- New Carlisle. Similar small bogs were observed around the margins of the lakes behind New Carlisle and elsewhere.

SALT MARSHES.

- Salt marshes, localities and area. Deposits of this character border some of the peat bogs just described, and skirt the shores and estuaries in numerous localities around the Baie des Chaleurs. A few of them produce hay, which is cut, and two or three are dyked. Unless in the Carboniferous area, in the eastern part of Gloucester county, they are narrow and unimportant, and much intersected by lagoons. At Caraquette and Pokemouche, however, some of them yield quantities of hay. The localities of the larger of these marshes will here be given.
- Pokemouche. 1. Around Pokemouche gully, skirting the cranberry barren referred to, and at St. Simon's Inlet, marginal areas of these are seen, some of which yield hay.
- Caraquette. 2. In Caraquette harbour they occur also in several places, for example, at the western end, around the mouths of Caraquette River and Symond's Brook (see map). The one at the former place lies chiefly on the south side, and below the bridge is a quarter to half a mile wide; that on Symond's Brook is a quarter of a mile or more wide at the bridge, and one and a half to two miles long.
- Restigouche estuary. 3. At the mouths of Peter's River and Grant's Brook, inside of the sand barrier, small patches of marsh occur.
- Nouvelle. 4. Inside of Eel River sand bar, narrow beds of this kind skirt the lagoon.
5. In the Restigouche estuary, areas of marsh border it at Athol House, and below Cross Point.
6. Around the estuary of Nouvelle River they are seen one to two miles long, and 200 to 300 yards wide on each side.

7, On the east side of Little Cascapedia River, around tide head, Cascapedia. deposits of this character also occur.

8. In Bonaventure River estuary, salt marshes skirt the terraces all Bonaventure. around.

Other localities, such as Bathurst Harbour, Tête-à-gauche estuary, and Other localities. around the lagoons, inside of the sand dunes at Belledune, Carleton, Paspebiac, etc., also Jacquet River estuary, part of the west end of Heron Island, a marginal strip at Shoolbred, and another at Maria, a patch near mouth of Little Bonaventure River, and another at the mouth of Nouvelle River (Shigawake) might be enumerated as exhibiting salt marshes of limited areas; but in most cases they are mere selvages, too small to map, and not of sufficient importance to describe.

ESTUARINE FLATS.

Estuarine flats are formed of deposits, chiefly detrital and fluvial, which have been laid down in harbours, inlets and mouths of rivers, the surface of which is littoral, that is to say, is flooded at high tides and laid bare, or nearly so, at the ebb. They are largely composed of river silt, (fine sand and clay); but sometimes coarser material is found in them; and they are always partly covered, at least, with eel-grass (*Zostera marina*) and other sea or brackish water plants. The principal places where they have been noted are:—

Estuarine flats, character of.

Principal places where noted.

1. In Pokemouche Harbour, skirting the shore.
2. At Point Mizzenette, inside Caraque Harbour.
3. In Bathurst Harbour, covering nearly the whole basin.
4. Inside of Restigouche estuary, from Point La Lime to the head of the tide, and occupying a large part of this area.
5. In Cascapedia Bay and estuary, also at mouth of Little Cascapedia River.

6. At mouth of Bonaventure River, and
7. Around the Port Daniel basin, in marginal flats.

These estuarine flats, more especially at Pokemouche and at the Restigouche and Cascapedia Rivers, form feeding grounds for the wild geese and brant (*Bernicla Canadensis* and *B. brenta*) which frequent this region in great numbers every spring and autumn.

AGRICULTURAL CHARACTER, FLORA, FAUNA, ETC.

A general description of the agricultural character of northern New Brunswick was given in the preliminary report already several times cited, and the geological relations and mode of origin of the soils and subsoils discussed in some detail. It was shown that the passage of glaciers over this region, from west to east, had distributed large quanti-

Agricultural character of region: where described.

General
character of
materials
constituting
soil.

ties of the coarse debris of the eruptive rocks (dolerites, felsites, diorites, etc.), which form dykes in the Silurian strata, and that, consequently, the land was stony in many places, especially near the coast. In Bonaventure county, a similar condition of things prevailed, and the great denudation the district underwent seems to have removed large portions of the finer material into the valleys, and the depression of the Baie des Chaleurs, leaving the coarser gravel and boulders in the soil. Notwithstanding this, however, there are excellent tracts of farming lands on the northern side of the bay, which will be more particularly referred to further on, and on the whole, it may be stated that its agricultural character is higher than that of the New Brunswick side. In the following brief description it is considered advisable to refer to each geological formation in the district mapped separately, showing, as nearly as possible, the relations existing between it and the superincumbent soil. The Silurian being the largest and most important area, a description of the soil resting upon these rocks will first claim attention.

CHARACTER OF SILURIAN UPLANDS.

Elevation,
extent and
quality of
Silurian
uplands.

The general aspect of the surface over all this large tract on both sides of the Baie des Chaleurs and Restigouche valley, is rolling, but it is deeply trenched by the rivers and streams which traverse it. As has been stated in previous reports, the portion of these uplands lying north and west of the Restigouche is almost entirely a table-land, varying in elevation from 800 or 900 feet to 1500 feet above sea-level, the height increasing northwards. Tracts of comparatively level land are, however, found between the river valleys on which the soil is often deep, generally free from stones, and fertile, the materials of which it is composed having been derived, in a large measure, from the rotting of the underlying Silurian slates. Unfortunately, not much progress has yet been made in forming settlements upon these Silurian uplands, their remoteness, want of roads, and other drawbacks operating against it. In Restigouche county, two or three settlements have been located upon them, however, and although meeting with difficulties and adverse circumstances at first, have recently been more successful. These are Balmoral, Blair Athol, Becketville, etc., in which, it may be remarked, the soil, although fertile, is somewhat stony, owing to their proximity to large trap dykes, and not by any means to be compared in agricultural value to that of the larger area of these lands in the interior. The people in these settlements are now, however, making substantial progress, the land, in addition to its good quality, being well wooded and watered, and having good natural drainage.

Settlements
established
on them.

St. Alexis,
progress of.

In Bonaventure county, a thriving new settlement called St. Alexis,

has been established on these table-lands, about seven miles west of the mouth of Metapedia River. Here, their height is 900 to 1000 feet above the sea, and the surface is undulating and comparatively free from boulders. While the clearings were small and confined, summer frosts prevailed to some extent; but latterly, these have not recurred so frequently, owing, probably, to the larger acreage of cleared land admitting a freer circulation of air. Indeed, it may be stated as a rule, that summer frosts occur oftener in valleys, and especially along water courses at some distance from the sea coast, than on these table-lands. A greater drawback is the increased quantity of snow which falls there, compared with that of the coast district, and which usually remains later on the ground in spring. Grain is later in maturing also, especially wheat; but all kinds of crops grow well. Upwards of one hundred families have taken up farms in this settlement, and are industrious and hopeful.

Summer frosts
and snow-fall.

Settlements have been located also at Little River and in one or two localities east of the Nouvelle valley, which are fairly prosperous, but they do not appear to have thriven like St. Alexis.

Little River
and Nouvelle.

Limestone is abundant in the Silurian area, and deposits of shell-marl occur in certain localities; but the former is burned only in small quantities, and is very seldom applied to the land. Only at Port Daniel is limestone quarried to any considerable extent, and from there it is shipped to Prince Edward Island, to be used chiefly for fertilizing purposes.

Limestone and
shell-marl in
Silurian area.

The chief trees found growing on the drier parts of the Silurian uplands, are, in the order of their relative abundance, as follows:—

Chief trees
on Silurian
uplands.

White spruce (<i>Picea alba</i>)	2 to 2½ feet in diameter above the roots.		
Black birch (<i>Betula lenta</i>)	2 to 3	"	"
Rock maple (<i>Acer saccharinum</i>)	2 to 2½	"	"
Balsam fir (<i>Abies balsamea</i>)	1 to 2	"	"
White birch (<i>Betula papyracea</i>)	2 to 2½	"	"
Do (<i>B. alba</i> , var <i>populifolia</i>)	1	"	"
Yellow birch (<i>B. lutea</i>)	1 to 1½	"	"
White pine (<i>Pinus strobus</i>)	2 to 3	"	"
Red pine (<i>P. resinosa</i>)	1 to 2	"	"
Beech (<i>Fagus ferruginea</i>)	1 to 2	"	"
Poplar (<i>Populus tremuloides</i>)	2 to 2½	"	"
Do (<i>P. grandidentata</i>)	2 to 2½	"	"
Red oak (<i>Quercus rubra</i>)	3 to 6 inches	"	"
Rowan tree (<i>Pyrus Americana</i>)	3 to 9	"	"
Ground hemlock (<i>Taxus baccata</i>)	1 inch or less	"	"

On the lower grounds and in swamps, the following species occur. They are also enumerated in the order of their abundance, the size given being the maximum attained:—

Trees on lower
grounds.

White cedar (*Thuja occidentalis*) 1 to 3 feet in diameter.

Hackmatac (*Larix Americana*) 1 to 2½ " "

White birch (*Betula papyracea*) 1 to 2 " "

White ash (*Fraxinus Americana*) 1 to 2½ " "

Black ash (*F. sambucifolia*) 1 to 1½ " "

Red maple (*Acer rubrum*) 1 to 1½ " "

Black spruce (*Picea nigra*) 1 to 1½ " "

White spruce (*P. alba*) 1 to 2 " "

Arrow-wood (*Viburnum*) 2 or 3 species 1 to 2 inches in diameter.

Trees along
banks and
intervals.

Along river banks and growing on intervals, the following trees are met with:—

Elm (*Ulmus Americana*) often 2 to 3 ft. in diam. above the roots.

Balsam poplar (*Populus balsamifera*) 2 to 3 " "

White spruce (*Picea alba*) 1 to 2 " "

White cedar (*Thuja occidentalis*) 2 to 3 " "

Balsam fir (*Abies balsamea*) 1 to 2 " "

White birch (*Betula papyracea*) 1 to 2½ " "

White ash (*Fraxinus Americana*) 1 to 2 " "

Black ash (*F. sambucifolia*) 1 " "

Red Maple (*Acer rubrum*) 1 " "

Rowan tree (*Pyrus Americana*) 3 to 9 inches " "

Alder (*Alnus incana*) 1 to 3 " "

Willow (*Salix*) several species 1 to 3 " "

Red osier (*Cornus stolonifera*) 1 " or less "

June-berry (*Amelanchier Canadensis*) 1 to 3 " "

On the dry banks and slopes of valleys, the following species are often found in addition to others enumerated above:—

Red pine (*Pinus resinosa*) 1 to 1½ feet in diameter.

Sumach (*Rhus typhina*) 1 inch or less "

Around the margins of clearings the undermentioned species may be seen in most places:—

Hazel nut (*Corylus rostrata*) 1 inch or less in diameter.

Elder (*Sambucus*) 2 species, 1 to 2 inches "

Cherry (*Prunus*) 2 or 3 species, including the choke cherry, 2 to 6 inches in diameter.

On sand dunes, Juniper (*Juniperus Sabina* var. *procumbens*) may often be found,—a low prostrate shrub half an inch or less in diameter.

Character of
trees on Upper
Restigouche
and affluents.

In the region drained by the Upper Restigouche and its tributaries there is generally a heavy growth of trees, such as spruce, birch, maple, elm, poplar, cedar, etc., the three last being often seen along the rivers, three feet or more in diameter. Large tracts here are still covered by the "forest primeval," apparently untouched by the lumberman's axe. Fires have consequently done less damage than elsewhere in New Brunswick, a few miles in the vicinity of Stillwater Brook being the only burnt woods seen along the main river. The Patapedia valley,

however, has been swept by fires for upwards of twenty miles some years ago, and large tracts there present only bare trunks and "blow-downs," with a scanty undergrowth. As a result of this, blue-berries (*Vaccinium Canadense*) abound, and in autumn bears are numerous.

CHARACTER OF SOIL OVERLYING DEVONIAN ROCKS.

The area of these rocks within the district mapped, is so limited, and the deposits derived from them are consequently so intermixed with those belonging to contiguous formations, that they really cannot be said to have a distinct character of their own. The rocks being largely composed of silicious and trap conglomerate, crumble down into a coarse, stony soil, as is seen wherever the debris resulting from their waste predominates. Small tracts of this kind occur at Seaumenac, Nouvelle and New Richmond.

SOIL OVERLYING LOWER CARBONIFEROUS ROCKS.

Lower Carboniferous sediments occupy coastal areas all around the Baie des Chaleurs, and, although in the aggregate, only of limited extent, yet from the fact that the tracts underlaid by them have nearly all become occupied by settlers, they are of considerable importance in an agricultural point of view. These rocks occur in the vicinity of Bathurst, but are so masked with fluvial and marine deposits that their influence on the overlying soil there is almost wholly obscured. Around Eel River basin, extending to Charlo River, on the one hand, and to the Restigouche, at Shaw's Cove, on the other (see geologically coloured map), a small area of these rocks is found; Heron Island is also formed of them, and in Bonaventure county, a belt of the Lower Carboniferous stretches from Seaumenac and Maguasha eastward, with a few interruptions, to Port Daniel. Between Black Cape and the latter place they are of sufficient width to give to the soil derived from and resting upon them distinct qualities. The strata, for the most part, occupy their original horizontal position, and the district underlaid by them is consequently flat. Moreover, as these rocks, when ground down, often produce clay, which at the depth of a few inches, forms a "hard-pan," the soil is often wet, and boggy or peaty areas are of frequent occurrence, owing to insufficient drainage. When the surface has sufficient slope, to afford a natural drainage of the surplus waters due to precipitation, however, the land is excellent, being friable, easily cultivated and productive. Several tracts containing good farms might be referred to, such as Heron Island, Maguasha, New Richmond, Capelin, Bonaventure, New Carlisle and Shigawake.

KIND OF SOIL OVERLYING MIDDLE CARBONIFEROUS ROCKS.

Kind of soil
upon Middle
Carboniferous
rocks.

Rocks of this age underlie that part of the district east of Salmon Beach, Gloucester county. The surface here is also flat, and the general aspect of the country tame and monotonous, relieved, however, to some extent, by the bold cliffs which face the Baie des Chaleurs at New Bandon and Pokeshaw. At Salmon Beach, the soil is clayey, being composed of till underneath, with a few inches of Leda clay over it. To the east of this, it is more gravelly or sandy as far as Grand Anse, where it again becomes partly of a clayey nature. This latter character prevails, indeed, in many of the lower tracts bordering the Bay and Gulf, and especially in river valleys. In these, however, the soil is more or less loamy.

In the districts occupied with clay deposits, the soil is generally more or less impervious to water, and being flat, like that underlain by Lower Carboniferous rocks, is also liable to be wet in spring, and during rainy seasons. It is nevertheless excellent for hay and cereals, and when lime in sufficient quantities is applied, is highly productive. The arenaceous tracts, on the contrary, constitute rather dry and hungry soils. Lime is the great *desideratum* for these, but more especially for the clayey lands.

Good quality
of land in
eastern
Gloucester.

A large part of eastern Gloucester is occupied with good arable land, which only requires proper cultivation to render it a desirable farming locality. At present, fishing and other occupations interfere, to some extent, with successful agricultural pursuits. The construction of the Caraquette Railway through it must enhance the value of land, however, affording, as it does, increased facilities of transport for agricultural produce, freestone, fish, etc., so abundant here.

SOILS UPON CAMBRO-SILURIAN AND PRE-CAMBRIAN ROCKS.

Character of
soil resting
upon Cambro-
Silurian and
Pre-Cambrian.

The character of the soil resting upon the Cambro-Silurian in Gloucester county was described in some detail in the preliminary report, 1885, and nothing further can be added respecting it. In general, it may be stated, the surface is boulder-strewn, and rock bosses are not infrequent; nevertheless, when cleared, the soil is found in many places to be deep and rich. At Point Maquereau, and behind Port Daniel, the tract occupied by these and the Pre-Cambrian rocks is more elevated and rugged, and plentifully covered with boulders. Here, however, it is almost entirely unsettled.

In regard to the districts underlain by Pre-Cambrian rocks alone at Tête-à-gauche and Jacquet rivers, and at Point Maquereau, occupying as they do only limited areas, it does not seem necessary to refer to them in detail. Wherever surface deposits are seen as solely, or in any

considerable part belonging to them, they form a poor, stony soil. These rocks, have, however, furnished large quantities of boulders and coarse material to the soils of contiguous districts.

The trees found growing upon the areas underlaid by the Carboniferous ^{Trees upon Carboniferous area.} and other rocks are much the same in regard to species and dimensions as those already enumerated as occurring on the Silurian, although somewhat different in their numerical relation. On the Carboniferous, however, we find in addition, the hemlock (*Tsuga Canadensis*) 1½ to 2½ feet in thickness above the roots; black spruce (*Picea nigra*), a larger tree, 1 to 2½ feet in thickness, and the scrub pine (*Pinus Banksiana*), a small tree, found on gravelly and sandy soils. The sweet fern (*Myrica asplenifolia*) is met with here only on the dry soil of the Carboniferous rocks.

FAUNA.

From the fact that the chief part of the area under review is ^{Fauna.} still covered by forests, it may be inferred that animals, of which they form the habitat, are more numerous here than in the southern counties of New Brunswick, and such, in the course of exploration, was found to be the case. The moose (*Alce Americanus*), caribou, ^{Animals inhabiting the forests.} (*Rangifer caribou*), the bear (*Ursus Americanus*), lynx (*Lynx Canadensis*), fox (*Vulpes vulgaris*), and the fur-bearing species, such as the beaver, (*Castor fiber*), otter, (*Lutra Canadensis*), pine marten, or sable, (*Mustela Americana*), the fisher, or black cat, (*M. Pennantii*), and the weasels (*Putorius vulgaris*), and *P. ermineus*, the mink (*P. vison*), the skunk, (*Mephitis mephitis*), the little brown bat, (*Vespertilio subulatus*), the common mole, (*Scalops aquaticus*), flying squirrel (*Sciuropterus volucella*), the common red squirrel, (*Sciurus hudsonius*), meadow mouse, (*Arvicola riparius*), musk rat, (*Fiber zibethicus*), porcupine, (*Erethizon dorsatus*), and hare, (*Lepus Americanus*), are found in greater or less numbers. The Restigouche and its tributaries are favourite hunting grounds.

The birds which frequent the province of New Brunswick are now being industriously studied by Mr. M. Chamberlain, of St. John, and other members of the Natural History Society, and a catalogue has been published (see Bulletin of the Natural History Society of N.B. Nos. I and II.)

The common crow (*Corvus frugivorus*), the robin, (*Merula migratoria*), ^{Birds.} besides the snow-birds usually observed, were seen in this district by the writer during the winter of 1885-86. The loon (*Colymbus torquatus*) frequents the open portions of the Baie des Chaleurs all winter.

Fish of many different kinds are proverbially abundant in the Baie ^{Fish.} des Chaleurs; and the Restigouche, Nepisiguit, Cascapedia, etc., are

Salmon and trout.

famous for salmon and trout. The smelt, (*Osmerus mordax*), which is also anadromous, goes up these waters at certain seasons, and great quantities are caught; indeed, smelt fishing has become an important industry of late years in the northern counties of New Brunswick during winter. Whitefish (*Coregonus albus*) are occasionally seen in some of the upper branches of the Restigouche, but they are scarce. The common eel (*Anguilla rostrata*), is speared in great numbers in the muddy estuaries.

Fish in Baie des Chaleurs.

The fish most abundant in the Baie des Chaleurs are well known, and need not be enumerated. The cod, mackerel, herring and capelin, the latter caught in great quantities along sand beaches and dunes with scoop-nets, and used for manuring the land, occur in great profusion, and often swarm in its waters; while others, such as the halibut (*Hippoglossus vulgaris*), the flounder, tom-cod, sculpin, etc., are also frequently caught. The basking shark, white whale, (*Delphinapterus catodon*) and the seal (*Phoca vitulina*) are rarely seen.

Crustaceans.

Of crustaceans, the lobster (*Homarus Americanus*) abounds all around the coasts. Of late years, however, owing to the great numbers caught, it has become considerably depleted, and fishermen report it as much smaller than formerly. The crab (*Cancer irroratus*) is plentiful, and the squid (*Ommatostrephes illecebrosa*) is sometimes thrown up on the shores of the south side of the Baie des Chaleurs; while the barnacle (*Balanus balanoides*?) is found adhering to the rocks, etc., everywhere in littoral waters.

Molluscan fauna.

The Baie des Chaleurs also supports an abundant molluscan fauna, closely similar to that which inhabits the southern part of the Gulf of St. Lawrence, where dredgings were made by Mr. Whiteaves some years ago.

MATERIALS OF ECONOMIC IMPORTANCE IN THE SURFACE DEPOSITS.

Materials of economic importance in the surface deposits.

The only materials of economic importance known to occur in the surface deposits of this district are those which have been cursorily referred to in previous pages, viz.: brick clays, shell marl and peat. Along with these may, perhaps, be classed fine sand, used in the manufacture of bricks and mortar, and gravels of different kinds suitable for road-making, ballasting railways, etc.

Brick-clay.

Brick-clay is found in the Leda clay beds in numerous localities around the Baie des Chaleurs; and also of fluviatile formation in river valleys in the interior. The manufacture of bricks is, however, carried on here merely to supply the local demand, which is not great. At Bathurst, a brick-kiln has been in operation for some years, and one was also started at Campbellton, but work in the latter place has recently been discontinued.

Brick-kilns.

Shell marl has been mentioned as occurring at Belledune, Charlo ^{Shell marls.} and New Richmond; and I am informed it is also found in one of the ^{where found.} small lakes behind the town of New Carlisle. It is used to a limited extent for fertilizing purposes and is said to be excellent for the heavier clay soils overlying the Lower and Middle Carboniferous tracts skirting the Baie des Chaleurs.

Peat is found in numerous places, nearly all of which are enumerated ^{Peat.} on pages 29 and 30 M (this report). It has not yet, however, been utilized in any way in this district.

Sands and gravels occur in ridges, terraces and beaches, and as ^{Sands and} already stated, are everywhere abundant. Fine blown sand, of use ^{gravels.} for the purposes above mentioned, can be found at numerous points around the Baie des Chaleurs, especially in the modern beaches, being developed in great masses at Eel River, Alston and Carron Points at Bathurst, Blue Cove and Point Mizzenette, Pokemouche, etc. It also occurs in the Saxicava sand deposits in various places. Gravel, suitable for the purposes above referred to, is found also in the Saxicava sand beds, particularly at Bathurst, Tête-à-gauche, New Mills, Christopher's Brook, etc. Pits (from which large quantities were taken) were opened in these and other localities during the construction of the Intercolonial railway.

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